experimentally reported. We attempt to establish correlation between the mechanistic models presented here and an earlier heuristic model that we have developed [6].

Reference:
1. R. J. Pelham, Jr., and Y. L. Wang, Proc. Natl. Acad. Sci. USA, **94**, 13661 (1997).
2. J. Solon et al, Biophys. J., **93**, 4453 (2007).
3. S. Tee et al, Biophys. J., **100**, L25 (2011).
4. U. S. Schwarz et al, Biosystems, **83**, 225 (2006).
5. J. M. Maloney et al, Phys. Rev. E, **78**, 041923 (2008).
6. S. Raghavan, A. R. Rammohan, and M. Hervy, Open J. Biophys, **3**, (2013).

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Water Potential of Cell Microenvironments Modulates their Proliferation

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Microenvironmental conditions in interstitial spaces can change rapidly after inflammatory insults. Hydration potential shifts of *50-150 mmHg* occur during burn and ischemia-reperfusion injury in dermal and myocardial extracellular matrices, respectively, presumably due to increased mechanical tension, fluid flux, and water activity as edema accumulates (McGee et al., *Biophys J 2012;Circ Res 2012a;Wound Rep Reg 2013*).While cell responses to mechanical and flow-related components of the hydration potential are increasingly studied and understood, responses to concomitant changes in water's chemical potential are not. Here, we explore its effects on *HL60*, an anchorage-independent, human leukemia cell line that readily differentiates towards various cell lineages. Cells *(10^5 /ml)* were grown in static suspension cultures at *37 °C*, in liquid media supplemented with *2.5%* fetal calf serum and at colloidosmotic pressures adjusted to between *1-100 mmHg* with inert polymers. After 24 hours, the cells' growth rate changed with the water chemical potential in direct proportion to the colloidosmotic pressure of the growth solution. Linear regression analyses showed that the slope of the growth rate versus pressure was *(2.4%)/day/mmHg(R^2 = 0.875)*. The observed rate changes were independent of the physicochemical characteristics of the inert polymer; *polyethyleneglycol 8000* or *dextran 10* enhanced cell proliferation. Cell differentiation pathways also appeared to change as determined by the cells morphology and size in Giemsa stained cytocentrifuge preparations and further suggested by a shift to the right in the frequency-distribution of their nucleus/cytoplasm ratios. These results show that changes in water's chemical potential modulate proliferation regardless of media-stiffness or flow sensing by the cell. Hydration potential components other than the mechanical play significant roles in cells' adaptation to changes in their microenvironment.

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Rapid Disorganization of Mammary Acini Driven by Long-Range Mechanical Interaction

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Cells and multicellular structures can mechanically align and concentrate fibers in their extracellular matrix (ECM) environment but can also sense and respond to mechanical cues by differentiating, branching, or disorganizing. Mechanically induced collagen concentration and alignment into arrangements variously referred to as fibers, tracts, cables, straps or lines has been seen in experimental systems ranging from single cells and tumor explants to human clinical samples. Here we show that pairs or groups of Ras-transformed mammary acini with thinned basement membranes and weakened cell-cell junctions can generate collagen lines that then coordinate and accelerate transition to an invasive phenotype. When two or more acini mechanically interact by collagen lines, the pairs or groups of acini begin to disorganize within 12.5 ± 4.7 h in a spatially coordinated manner, whereas acini that do not interact mechanically with other acini disorganize more slowly (21.8 ± 4.1 h) and to a lesser extent ($p<0.0001$). Overall, disorganization of mechanically interacting pairs of acini is more probable, rapid, and extensive than of single acini. When the directed lateral mechanical interconnections between paired acini were laser-severed, the acini reverted to the slow disorganization phenotype. When acini were mechanically isolated from other acini and also from the bulk gel by box-cuts with a side length below 900 μm, transition to an invasive phenotype was blocked in 20 of 20 experiments. Thus, pairs or groups of mammary acini can interact mechanically over long distances through the collagen matrix and these directed mechanical interactions are necessary for rapid transition to an invasive phenotype.

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Dorsal Adhesion Slows Glioblastoma Migration in Perivascular Mimics

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Glioblastoma multiforme (GBM), the most prevalent primary brain cancer, is characterized by diffuse infiltration of tumor cells into brain tissue, which severely complicates surgical resection and likely gives rise to the almost universal tumor recurrence. This diffuse infiltration is frequently guided by anatomical "tracks" in the brain in the form of blood vessels or white matter tracts, which give rise to the highest migration speeds observed in vivo. Despite this observation, little is known about the biophysical and biochemical mechanisms through which these tissue interfaces promote invasive motility, which in turn may derive from a lack of appropriate culture paradigms. To address this need, we developed a culture system in which tumor cells are sandwiched between a ventral fibronectin-coated dorsal surface representing vascular basement membrane and a dorsal hyaluronic acid (HA) surface representing brain parenchyma. We find that inclusion of the dorsal HA surface induces formation of adhesive complexes and significantly slows cell migration relative to a free fibronectin-coated surface. This retardation is amplified by inclusion of integrin binding peptides in the dorsal layer and expression of CD44, suggesting that it acts through biochemically specific mechanisms rather than simple physical confinement. Moreover, both the reduction in migration speed and assembly of dorsal adhesions depend on myosin activation and the stiffness of the ventral layer, implying that mechanochemical feedback directed by the ventral layer can influence adhesive signaling at the dorsal surface.

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Length Scale Dependent Micro-Rheology of Cellularized Type I Collagen Gels

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Collagen gels are commonly used as the substrate for experiments on cell mechanics because collagen is the most abundant protein in the extracellular matrix of most animals. The gels are commonly approximated as homogeneous elastic materials; however, on smaller length scales, the inhomogeneity of the collagen fiber network becomes very apparent. During gelation, collagen fibers can group together to form larger fiber bundles, with the size, shape, and distribution of these bundles depending on the collagen concentration and the temperature during gelation. In addition, when cells are embedded in the collagen substrate, the cell adhesion forces deform the collagen and alter its elastic properties. We study local variation in the elastic modulus of type I collagen gels and characterize inhomogeneity caused by cell adhesions and fiber bundles in the collagen network. We expect the cell adhesions and the collagen fiber bundles to each have distinct length scales over which the elastic properties will vary. These length scales will be calculated by separating the gel into domains in which the elastic properties of the collagen change in a characteristic way. We map the local elastic modulus of type I collagen gel using active two-point micro-rheology. Optical tweezers are used to perturb microscopic particles embedded in the gel and in-line holographic particle tracking is used to calculate the particle displacements. The local elastic properties are calculated by cross-correlating the trajectory of the perturbed particle with the trajectories of the surrounding particles. Then confocal reflection microscopy is used to image the collagen fiber network, showing the locations of cells and fiber bundles. These images are used to compare the distribution of cells and fiber bundles to the results of the local micro-rheology calculations.

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Intermediate Filament Structure, Assembly and Nanomechanics

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Intermediate filaments (IFs) consist of two-stranded coiled coils that form anti-parallel, half-staggered tetramers. By time-lapse electron microscopy, complemented with total internal reflection fluorescence (TIRF) microscopy, we have investigated the in vitro assembly of vimentin to define the assembly pathway for vertebrate cytoplasmic IFs. First, we have characterized the physical and structural state of the soluble vimentin subunits by analytical ultracentrifugation (AUC) and X-ray crystallography. Assembly is induced by a change in the ionic strength and starts with the lateral association of tetramers to full-width unit-length filaments (ULFs) driven by the interaction of the